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Session 6 - Environmental Systems: Management and Optimisation

Session 7 - New Methods and Technologies for Medicine and Biology

Session 8 - Embedded System Design and Application

Session 9 - Image Processing, Image Analysis and Computer Vision

Session 10 - Mobile Communications

Session 11 - Education in Computer Science and Automation

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Preface

Dear Participants,

Confronted with the ever-increasing complexity of technical processes and the growing demands on their efficiency, security and flexibility, the scientific world needs to establish new methods of engineering design and new methods of systems operation. The factors likely to affect the design of the smart systems of the future will doubtless include the following:

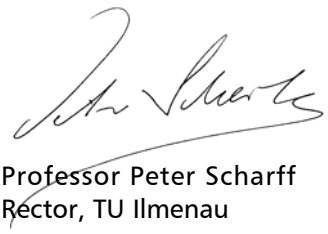
- As computational costs decrease, it will be possible to apply more complex algorithms, even in real time. These algorithms will take into account system nonlinearities or provide online optimisation of the system's performance.
- New fields of application will be addressed. Interest is now being expressed, beyond that in "classical" technical systems and processes, in environmental systems or medical and bioengineering applications.
- The boundaries between software and hardware design are being eroded. New design methods will include co-design of software and hardware and even of sensor and actuator components.
- Automation will not only replace human operators but will assist, support and supervise humans so that their work is safe and even more effective.
- Networked systems or swarms will be crucial, requiring improvement of the communication within them and study of how their behaviour can be made globally consistent.
- The issues of security and safety, not only during the operation of systems but also in the course of their design, will continue to increase in importance.

The title "Computer Science meets Automation", borne by the 52nd International Scientific Colloquium (IWK) at the Technische Universität Ilmenau, Germany, expresses the desire of scientists and engineers to rise to these challenges, cooperating closely on innovative methods in the two disciplines of computer science and automation.

The IWK has a long tradition going back as far as 1953. In the years before 1989, a major function of the colloquium was to bring together scientists from both sides of the Iron Curtain. Naturally, bonds were also deepened between the countries from the East. Today, the objective of the colloquium is still to bring researchers together. They come from the eastern and western member states of the European Union, and, indeed, from all over the world. All who wish to share their ideas on the points where "Computer Science meets Automation" are addressed by this colloquium at the Technische Universität Ilmenau.

All the University's Faculties have joined forces to ensure that nothing is left out. Control engineering, information science, cybernetics, communication technology and systems engineering – for all of these and their applications (ranging from biological systems to heavy engineering), the issues are being covered.

Together with all the organizers I should like to thank you for your contributions to the conference, ensuring, as they do, a most interesting colloquium programme of an interdisciplinary nature.
I am looking forward to an inspiring colloquium. It promises to be a fine platform for you to present your research, to address new concepts and to meet colleagues in Ilmenau.



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Rector, TU Ilmenau

Professor Christoph Ament
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A. Khatanbaatar Altantuul

The need designing integrated urban water management in cities of Mongolia

SECTION 6.

Mongolia locates in Central Asia, has severe continental climate, insufficient stock of surface water supply for centralized system of urban areas. Average rainfall is in the range of 200 to 250 mm and significant part of this water evaporates or drains out and remained small part of the water feeds underground water. As a source of the centralized water supply only underground water, fed by water in stratum and their cracks. Water consumption depends on climate condition and living specifics of users.

But in recent years customary usage of water is changed by different reasons. The tendency to increase in the quantity is observed for all kinds of consumers, and it is especially noticed for municipal water supply, which is 70 percent of all consumed water.

In the opinion of experts, it became clear that the increase of consumed water in conditions of deficiency of water resources can be limited by number of actions including: implementing management of segment tariffs with norm of water consumption; reducing water loss; re-usage of water; forecasting of water need based on natural demography of the population. To reveal the causes of growing water consumption in the present situation of city Ulaanbaatar, natural experiments have been done. In this study, hourly measurements of the chosen factors (*H, Z* are made*, q_n)* were taken within several months (December, March, June, August) on 12 central thermal points that supplied 43 apartments and their 33633 inhabitants. The research work was conducted through the following stages:

1. Statistical sampling of objects (apartments) by the degree of well-being, which differ in height, population, pressure on input of water system, level of operation of system.
2. Continuous measurement of hourly charges of water, pressure in the system and amount of night consumption were taken on water-measured units.

Based on the findings, the mathematical model that shows relationships between basic influencing factors as the below:

$$Q(q_n, z, H) = a_0 + a_1 \cdot q_n^{p_{qn}} + a_2 \cdot z^{p_z} + a_3 \cdot H^{p_H} \qquad (1)$$

In where:

$Q\ (q_n.z,\ H)$= values of the daily specific consumption of water (liter per day-person)

$q_n,\ z,\ H$= factors of influence on process of water consumption

q_n - *loss of water in system of water supply,*

z - *population of apartments,*

H-water tariff

$p_{qn},\ p_z,\ p_H$ - degrees of corresponding modeling factors which are from literature review equals as a rule $p_{qn} = p_z = p_H = 1$.

Using the method of the least squares, from the average values of the water consumption and major factors, coefficients and degrees of given regression equations (1) were determined as showed below:

$a_0=120.96 \quad a_1=26.45 \quad a_2=0.576 \quad a_3=0.175 \quad p_{qn}=0.5 \quad p_z=3 \quad p_H=1.5$

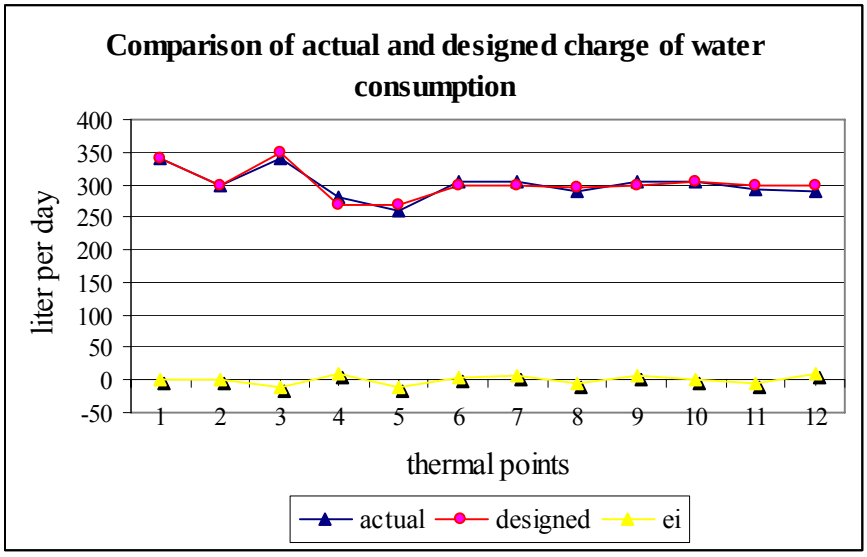
Finally, mathematical model that describes specific average daily water consumption becomes:

$$Q(q_n, z, H) = 120.96 + 26.45 \cdot q_n^{0.5} + 0.576 \cdot z^3 + 0.175 \cdot H^{1.5} \qquad (2)$$

Values of Q_{fi}- factual average daily water consumption and values of Qi, calculated through given model (2) are shown in Figure 1, and values are no viscous:

$e_i = Q_{fi} - Q_i$,

Figure 1



The table below shows test results of coefficients a_0, a_1, a_2, a_3.

table 1

Coefficients at factors – a_j	*120.96*	*26.45*	*0.575*	*0.175*
Estimations of quaintly distributions of Students –t_j	*8.513*	*2.08*	*0.041*	*0.012*

From the table it is visible, that a_0 and a_1 are significant only. Therefore, generally it is possible to use simplified model (3), in which $\Phi(q_n)$ ─ dependence function of water consumption on water loss (q_n):

$$\Phi(q_n)=120.96+26.45\cdot q_n^{0.5} \qquad (3)$$

The empirical conclusion of significant water loss in municipal sector is also approved by the balance report of activities of the water supply and sewerage authority of city Ulaanbaatar.

table 2

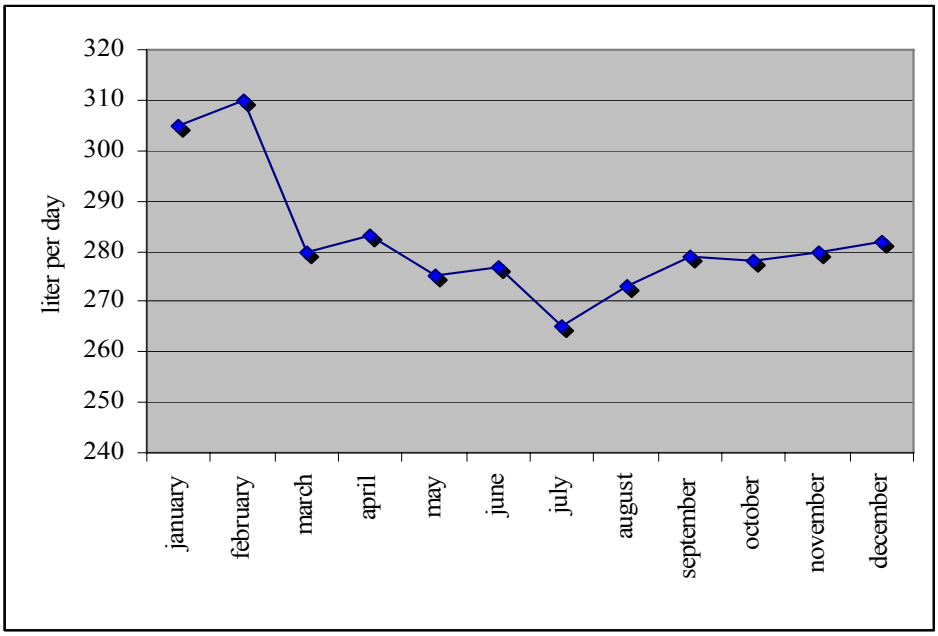
The amount of loss water in percentage

1998	1999	2000	2001	2002	2003	2004	2005
56.6	34.4	34.3	35.7	34.7	24.6	26.5	29.1

On the basis of the taken measurements some prominent features of water consumption of population of city Ulaanbaatar are determined:

- Water consumption during cold season is higher than that of warm season. This can be explained by the specifics of lifestyle of the population, custom of water usage and fluctuating demography of the city population (Figure 2)

Figure 2



In Mongolia's situation, the change of the water consumption of population also can be explained by its dependency on the change of air temperature. Relationship between specific water consumption and air temperature can be stated as below:

$$Q(T)=266,18-0,646\cdot T+0,04\cdot T^2 \qquad (3)$$

In which, *T-an ambient temperature*.

Analysis of full-scale investigation and received empiric dependence shows a necessity of adjusting the following factors having an influence on water consumption.

Firstly, loss of water in the water supply system basically caused by unadjusted pressure in the water supply system, technical status of system and lack of real calculation of water by consumers.

Secondly, occupancy of houses or free occurrence number of consumers which are changeable due to seasons of year. According to statistics, population of Ulaanbaatar has been increasing by 3% a year which causes difficulties in water supply.

Thirdly, tariffics of water at the present time requires an urgent solution of problem. Distinctive features of water supply to the populated area of Mongolia are classified in to 2 types: stationary and delivery. About 40 percent of population of Ulaanbaatar are fed from central water supply / 1 cube meter is valued at 300 tugrig*, a remained share of water supply felt to delivery supply of which tariff is 500 tugrig/ cube meter. Tariffics in connection with segmentation of service market will assist to settle a lot of problems of water supply.

Fourthly, Establishment of fixed rates of water to the houses connected with centralized water supply. Recently, rate of water allocation which is 230 liters per one person a day and night acts officially throughout capital city. It acts for people who are fed from centralized water supply. In comparison with world standard, this rate is overvalued. 120 liters a day and night are taken a priori by us (formula 1).

The specialist have determined that one of the ways of economy of water in housing sector of urban area is decreasing an amount of consumable water to technologically required level in other words to social rate of water consumption by population. But water need of everyone is individual's "accidental quantity" and stipulated for influencing a lot of factors which predetermine different kinds of study of this problem.

At that time, by bringing a rate of water supply close to world standard we can optimize hydraulic calculation of network, make forecast for amount of water in the plan of resource-economy.

Current situation and analysis of the conducted full-scale investigation show a necessity of implementing an integrated management in the sector of water supply to the cities of Mongolia.

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* tugrig- Mongolian currency

References:

1. Works Novosibirsk State University of Architecture and Civil Engineering . p 49-54, Russia "A condition of water distribution to the population in Ulaanbaatar City" 2000.
2. News of VYZ. Civil engineering-, №12 p. 63-66, Russia "Definition of a model of water consumption on the basis regression analysis of the population" 2003
3. 18-21 November 2003 , Kemerovo, p. 86-88, Russia "The influence of operational characteristics on the optimization calculations for water supply and distribution systems" 6-th the international scientific - practical conference.

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